



UL 2006

**Underwriters Laboratories Inc.
Standard for Safety**

Halon 1211 Recovery/
Recharge Equipment

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UL Standard for Safety for Halon 1211 Recovery/Recharge Equipment, UL 2006

Fifth Edition, Dated September 8, 2011

Summary of Topics

This New Edition of UL 2006 is being issued to include the following changes in requirements:

Revisions to general component requirements

Deletion of Appendix A and addition of related component requirements to the body of the standard

Revisions to clarify requirements for the construction of barriers

Revisions to specify the materials and permit an additional option for gaskets

Revisions to add references to component standards used on halon 1211 recovery/recharge equipment

Revisions to add component standard references for switches and controllers

Revisions to clarify requirements for capacitors

Revisions to clarify requirements for protective electronic circuits.

Addition of requirements to permit the use of spacings complying with the requirements of UL 840

Revisions to clarify requirements for the strain relief test

Revisions to define enclosures and cabinets

Revisions to polymeric parts requirements

Addition of exception to 45.1 and revision to 45.2 to include reference for testing with a dc potential

Revisions for editorial clarification

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated June 10, 2011.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover Halon 1211 recovery/recharge equipment rated 600 volts or less, and intended to be used in ordinary locations in accordance with the National Electrical Code, NFPA 70.

1.2 Halon 1211 recovery/recharge equipment covered by these requirements is intended for commercial use to recover/recharge Halon 1211 in fire equipment, including but not limited to portable, wheeled and automatic units and extinguishing systems.

1.3 These requirements apply to equipment intended for indoor or outdoor use, or both and to battery operated equipment.

1.4 These requirements include an evaluation to determine that the equipment recovers/recharges Halon 1211 to an adequate fire extinguishing performance level for reuse.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 Units of Measurement

2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

2.2 Unless indicated otherwise, all voltage and current values mentioned in this standard are rms.

3 References

3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

4 Terminology

4.1 The term "product" refers to any equipment covered by the Scope of this standard.

5 Glossary

5.1 For the purpose of these requirements, the following definitions apply.

5.2 BARRIER – A partition for isolating high-voltage electrical components, separating ignition sources from flammable materials, isolating moving parts and protection of wiring.

5.3 CABINET – The part of the equipment that provides physical protection to insulated wiring, enclosures, moving parts, motors, enclosed electrical parts, tubing or other parts that may cause injury to persons.

5.4 CIRCUITS, ELECTRICAL:

a) High-Voltage – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

b) Low-Voltage – A circuit involving a potential of not more than 30 volts alternating current, 42.4 volts peak or direct current, and supplied by a primary battery, standard Class 2 transformer, or a combination of a transformer and fixed impedance which, as a unit, complies with all performance requirements for a Class 2 transformer.

5.5 COMPONENT – A device or fabricated part of the equipment covered by the scope of a safety standard dedicated to that purpose. If incorporated in the equipment, a product that is otherwise typically field installed (e.g. luminaire) is considered to be a component. Unless otherwise specified, materials that compose a device or fabricated part, such as aluminum or copper, are not considered components. Generally, components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under specific, limited conditions, such as certain temperatures not exceeding specified limits.

5.6 CONTROL, OPERATING – A device or assembly of devices, the operation of which starts or regulates the end product during normal operation. For example, a thermostat, the failure of which a thermal cutout/limiter or another layer of protection would mitigate the potential hazard, is considered an operating control. Operating controls are also referred to as "regulating controls".

5.7 CONTROL, PROTECTIVE – A device or assembly of devices, the operation of which is intended to reduce the risk of electric shock, fire or injury to persons during normal and reasonably anticipated abnormal operation of the equipment. For example, a thermal cutout/limiter, or any other control/circuit relied upon for normal and abnormal conditions, is considered a protective control. Protective controls are also referred to as "limiting controls" or "safety controls" and are investigated under normal and single-fault conditions.

5.8 DESIGN PRESSURE – The maximum acceptable working pressure for which the equipment or a specific part is designed.

5.9 ENCLOSURE – The part of the equipment that does one or more of the following:

a) Isolates ignition sources,

b) Renders inaccessible all or any part(s) of the equipment that may otherwise present a risk of electric shock,

c) Retards propagation of flame initiated by electrical disturbances occurring within.

5.10 FUNCTIONAL PART – A part other than an enclosure or cabinet used to maintain the intended relative physical position of fixed or moving parts, or maintain the integrity of the structure.

5.11 IGNITION SOURCE – Any high-voltage electrical component not located within an enclosure.

5.12 MOTOR, DIRECTLY ACCESSIBLE – A motor that can be contacted without opening or removing any part, or that is located so as to be accessible to contact.

5.13 MOTOR, INDIRECTLY ACCESSIBLE – A motor that is accessible only by opening or removing a part of the cabinet, such as a guard or panel that can be opened or removed without using a tool, or that is located at such a height or is otherwise guarded or enclosed so that it is unlikely to be contacted.

5.14 NONFUNCTIONAL PART – A part of the equipment that does not perform a specific function.

5.15 NONFUNCTIONAL PART, SMALL – A nonfunctional part having an area of less than 1 ft² (0.093 m²) located so it cannot propagate flame from one area to another, and does not connect a possible source of ignition to the other ignitable parts.

5.16 PIPING – Includes pipe, flanges, bolting, gaskets, valves, fittings, the pressure-containing parts of other components, such as strainers and devices that serve such purposes as mixing, separating, muffling, snubbing, distributing, metering, or controlling flow.

5.17 RECHARGE – The act of removing contaminants in recovered Halon 1211 by single or multiple passes through devices, such as replaceable core filter-driers, that reduce moisture and particulate matter. Recharge usually occurs at the field job site or at a local service shop.

5.18 RECOVERED HALON 1211 – Halon 1211 that has been removed from fire equipment for the purpose of storage, recharging, or transportation.

5.19 RECOVERY – The act of removing Halon 1211 in any condition from fire equipment and storing it in an external container without necessarily testing or processing it in any way.

CONSTRUCTION

6 General

6.1 A product shall employ materials found by investigation to be acceptable for the intended application.

6.2 A component shall:

- a) Comply with the safety standard covering that component;
- b) Be used in accordance with its rating(s) established for the intended conditions of use;
- c) Be used within its established use limitations or conditions of acceptability;
- d) Comply with the applicable requirements of this end product standard; and
- e) Not contain mercury.

Exception: A component of a product covered by this standard is not required to comply with a specific component requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product, or;*
- b) Is superseded by a requirement in this standard, or;*
- c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.*

6.3 A component that is also required to perform other necessary functions, such as overcurrent protection, ground-fault circuit interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable standard(s) covering products that provide those functions.

7 Barriers

7.1 A barrier shall be formed from one or more of the following:

- a) Metal, minimum 0.005 inch (0.13 mm) thick;
- b) Fiberglass, minimum 0.5 inch (12.7 mm) thick;
- c) A nonmetallic material rated 5VA;
- d) A nonmetallic material evaluated to the 127 mm (5 inch) End Product Flame Test as described in UL 746C;
- e) Vulcanized fiber, varnished cloth, mica or phenolic composition, minimum 0.028 in. (0.71 mm) thick; or
- f) Any other material or construction determined to be equivalent to items (a) to (e).

7.2 barrier shall be secured to the mounting surface such that tools are required for its removal.

7.3 Except as specified in 7.5 and 12.5.2(b), a nonmetallic barrier that isolates ignition source(s) shall comply with the enclosure requirements of Table 67.1.

7.4 A nonmetallic barrier providing mechanical protection shall comply with the cabinet requirements of Table 67.1.

7.5 A barrier made of the materials specified in 7.1(e) but less than 0.028 in. (0.71 mm) thick shall:

- a) Be used in a location such that the air spacing between the parts being insulated by the barrier is not less than one-half of the required through-air spacing; and,
- b) Not be less than 0.013 inch (0.3 mm) thick.

8 Assembly

8.1 Recovery/recharge system

8.1.1 The equipment shall be provided with a means to observe the presence of liquid Halon 1211 in the system, such as a liquid indicator having a sight port, to determine if the halon is discolored or contaminated with particulate matter.

8.1.2 The equipment shall incorporate a moisture indicator that indicates the moisture content of Halon 1211 and with a color chart, mounted adjacent to the indicator, that relates the moisture content to the color of the indicator.

8.1.3 The equipment shall be provided with a filter-drier that incorporates a desiccant package having a minimum volume of 48 cubic inches (787 cm³) that is intended to be replaced when saturated with moisture and a filter with a 15 micron or smaller porosity to remove solid matter.

8.1.4 The equipment shall be provided with a minimum of two transfer hoses, each having a minimum length of 3 feet (0.9 m), to permit connection to the fire equipment being repaired or serviced and to the storage container charging adapter. One end of each hose shall incorporate a Compressed Gas Association (CGA) 660 female type fitting and the other end of each hose a self-sealing quick-connect type coupling.

8.1.5 The equipment pressure system shall incorporate a self-restoring type pressure relief valve(s). The start-to-discharge pressure setting of the pressure relief valve(s) shall relieve excessive pressures automatically on all components and the reclose pressure setting shall reduce unnecessary emissions of Halon 1211.

8.1.6 Equipment having provision for the storage of halon containers or the like shall be provided with:

- a) A means for retaining the containers in position.
- b) A means, such as the use of scales and a shutoff device, to terminate the recovery/recharge operation when or before the container liquid level reaches 90 percent of container capacity at 70°F (21.1°C).

8.1.7 Pressure-containing parts shall be factory connected with piping or tubing complying with the requirements specified in Table 40.1.

8.2 Mechanical protection

8.2.1 A product shall be assembled so that it will not be adversely affected by the vibration of operation. Brush caps shall be tightly threaded or otherwise constructed to prevent loosening.

8.2.2 A switch other than a through-cord switch, a lampholder, an attachment-plug receptacle, a motor-attachment plug, or similar component shall be mounted securely and shall be prevented from turning. See 8.2.4.

Exception No. 1: A switch need not be prevented from turning if all four of the following conditions are met:

- a) The switch is of a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch during operation of the switch.*
- b) The means for mounting the switch make it unlikely that operation of the switch will loosen it.*
- c) The spacings are not reduced below the minimum required values if the switch rotates.*
- d) The operation of the switch is by mechanical means rather than by direct contact by persons.*

Exception No. 2: A lampholder of the type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, need not be prevented from turning or shifting in position, if such motion does not result in a reduction of spacings below the minimum acceptable values.

8.2.3 Uninsulated live parts shall be secured to the base or mounting surface so that they will be prevented from turning or shifting in position, if such motion may result in a reduction of spacings below the minimum required values.

8.2.4 The means for preventing the turning or shifting mentioned in 8.2.2 and 8.2.3 shall consist of more than friction between surfaces – for example, a properly applied lock washer is acceptable as the means for preventing a small stem-mounted switch or other device, having a single-hole mounting means, from turning.

9 Enclosure

9.1 General

9.1.1 A product shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without resulting in a risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other defects.

9.1.2 Outlet boxes shall comply with the Standard for Metallic Outlet Boxes, UL 514A or the Standard for Nonmetallic Outlet Boxes, Flush Device Boxes, and Covers, UL 514C. Fittings shall comply with the Standard for Conduit, Tubing and Cable Fittings, UL 514B. Cover plates shall comply with the Standard for Cover Plates for Flush-Mounted Wiring Devices, UL 514D.

9.1.3 Wireways, auxiliary gutters and associated fittings shall comply with the Standard for Wireways, Auxiliary Gutters and Associated Fittings, UL 870.

9.2 Metal enclosures

9.2.1 Cast and sheet-metal portions of an enclosure shall not be thinner than the applicable values specified in Table 9.1.

Exception: Thinner metal can be used provided the surface under consideration is curved, ribbed, or otherwise reinforced to provide mechanical strength equivalent to that required.

Table 9.1
Thickness of enclosure metal

Metal	Minimum thickness, inch (mm)			
	At small, flat, unreinforced surface and at a surface of a shape or size to provide mechanical strength		At a relatively large unreinforced flat surface	
Die-cast metal	3/64	(1.2)	5/64	(2.0)
Cast malleable iron	1/16	(1.6)	3/32	(2.4)
Other cast metal	3/32	(2.4)	1/8	(3.2)
Uncoated sheet steel	0.026	(0.66)	0.026	(0.66)
Galvanized sheet steel	0.029	(0.74)	0.029	(0.74)
Nonferrous sheet metal	0.036	(0.91)	0.036	(0.91)

9.3 Nonmetallic parts

9.3.1 All nonmetallic parts, except for small nonfunctional parts shall comply with 9.4 – 9.6 and Table 63.1.

9.3.2 In addition to the requirement in 9.3.1, nonmetallic materials that serve as electrical insulation or that directly support live parts shall comply with the requirements for electric insulation in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

9.4 Nonmetallic materials

9.4.1 Materials shall be classified with respect to flammability characteristics that are established by the tests specified in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

9.4.2 Materials shall be assigned flammability ratings based on greatest to least resistance to flame and are identified as: 5VA, 5VB, V-0, V-1, V-2, HF-1, HF-2, HB, and HBF.

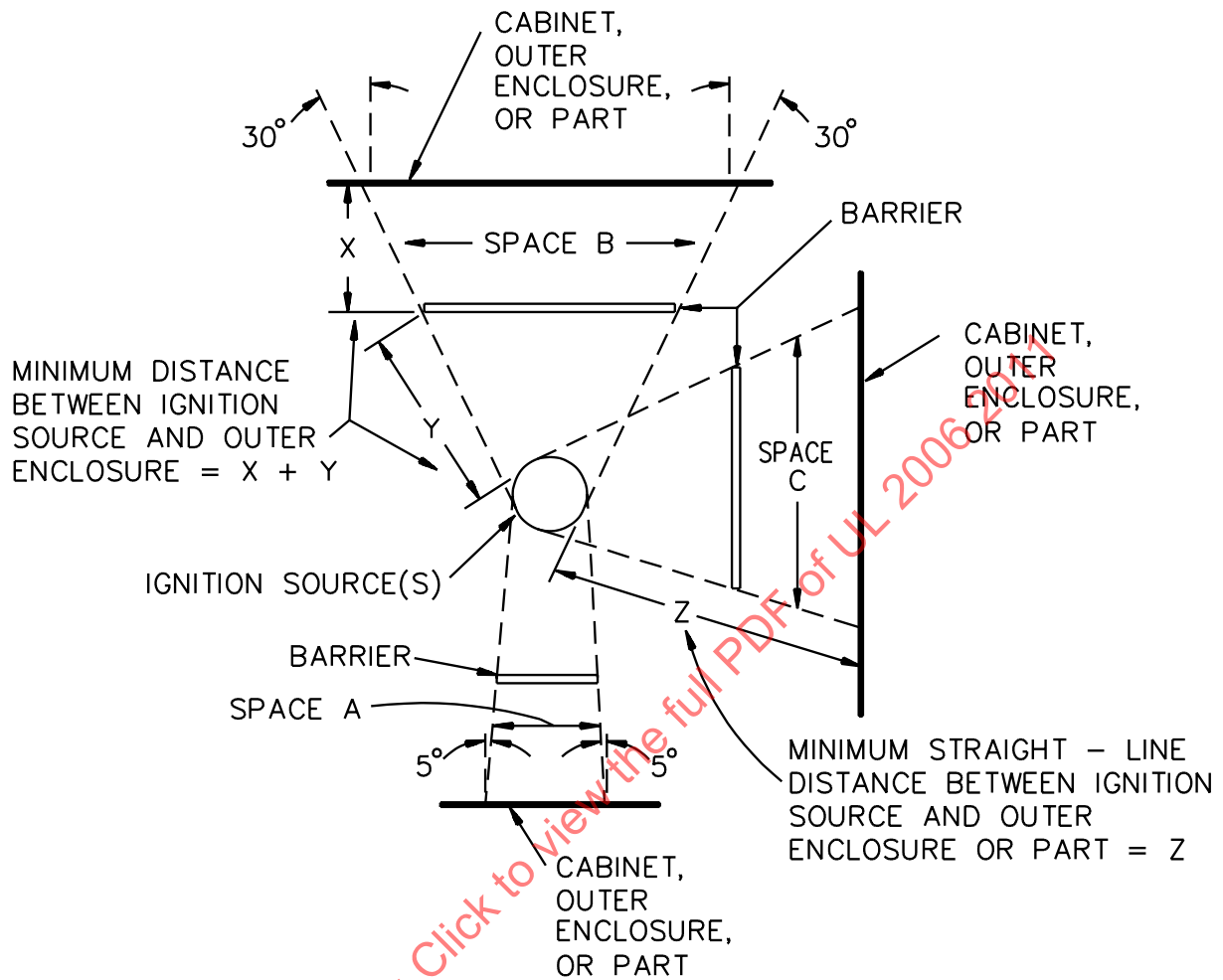
9.4.3 In reference to 9.4.2, the assigned flammability rating shall be appropriate for the material-use application in accordance with 9.5 and Table 63.1.

9.5 Nonmetallic material ignition sources separation

9.5.1 Parts formed from nonmetallic materials that are rated HB or HBF and positioned as shown in Figure 9.1 shall be separated from ignition sources by means of a barrier, extending at least to the boundary surface of the space whenever such parts are located:

- a) Below an ignition source and within Space A; and
- b) Above an ignition source and within Space B; and
- c) In the vertical plane relative to an ignition source and within Space C.

Figure 9.1
Separation of ignition sources from nonmetallic materials



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Notes:

Space A – Represents the volume below the ignition source determined by a straight line that moves about the ignition source while remaining at the angle of 5° degrees from the vertical and is always so oriented that the volume is maximum.

Space B – Represents the volume above the ignition source determined in the same manner as Space A, except that the angle is 30° degrees from the vertical.

9.5.2 The HB or HBF materials referenced by 9.5.1 shall be located such that the distance between:

- a) High-voltage wiring not employing VW-1 insulation and the HB or HBF materials shall be a minimum of 2 inches (51 mm), and
- b) Any other ignition source and the HB or HBF materials shall be a minimum of 4 inches (102 mm).

9.5.3 In reference to 9.5.2 and Figure 9.11, the minimum distance for HB or HBF materials located:

- a) Above the ignition source shall be as shown in Distance X + Y; and
- b) In the vertical plane relative to the ignition source shall be as shown in straight-line Distance Z.

9.6 Nonmetallic material application and location

9.6.1 Nonmetallic materials shall comply with the applicable tests as described in Table 63.1.

9.6.2 Nonmetallic fasteners used as a part of the enclosure shall comply with the Fastener Strength Test in 63.

9.7 Enclosure integrity

9.7.1 The enclosure shall prevent molten metal, burning insulation, flaming particles, or the like from falling on flammable materials, including the surface upon which the product is supported.

9.7.2 The requirement in 9.7.1 will necessitate that a switch, a relay, a solenoid, or the like be individually and completely enclosed, except for terminals, unless it can be shown that malfunction of the component would not result in a risk of fire, or there are no openings in the bottom of the product enclosure. It will also necessitate the use of a barrier of nonflammable material:

- a) Under a motor unless:
 - 1) The structural parts of the motor or of the product provide the equivalent of such a barrier;
 - 2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the product when the motor is energized under each of the following fault conditions:
 - i) Open main winding,
 - ii) Open starting winding,
 - iii) Starting switch short-circuited, and
 - iv) Capacitor of permanent-split capacitor motor short circuited – the short-circuit is to be applied before the motor is energized, and the rotor is to be locked;